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**discussion paper**

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# Temporary Work Agencies and Equilibrium Unemployment

Michael Neugart and Donald Storrie*

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## Abstract:

During the 1990s, temporary agency work has increased rapidly in most OECD countries. We augment the equilibrium unemployment model developed by Pissarides and Mortensen with temporary work agencies. Our model implies that technological improvements for placements and de-regulation of the sector caused the emergence and growth of temporary agency work. Simulations of a calibrated version of the model show that `temp' work does not necessarily crowd out other, ‘regular’ jobs.

## Zusammenfassung:

Während der neunziger Jahre stieg der Anteil der Zeitarbeit gemessen an der Gesamtbeschäftigung in fast allen OECD Ländern stark an. Wir erweitern das von Pissarides und Mortensen entwickelte Arbeitsmarktmodell mit Zeitarbeit. Auf der Grundlage unseres Modells lässt sich zeigen, dass technologische Veränderungen in der Informations- und Kommunikationstechnologie und die Deregulierung der Zeitarbeit Aufkommen und Wachstum des Zeitarbeitssektors verursachten. Simulationen des kalibrierten Modells legen nahe, dass Zeitarbeit nicht notwendigerweise Normalarbeitsverhältnisse verdrängt.

## Contents

# 1 Introduction

During the 1990s temporary agency work has increased rapidly in practically all OECD countries. In every Member State of the European Union (except Greece where it is illegal), temporary agency work has at least doubled during the 1990s, and in Scandinavia, Spain, Italy and Austria, it has increased at least five-fold. By the end of the decade it accounted for 1.3 percent of the stock of employment in the EU, Storrie (2002). The United States has also seen a doubling of agency employment in the 1990s. By the end of the decade, agency work accounted for 2.2 percent of total employment, Autor (2001a).

Temporary agency work is the most recent expression of the proliferation of employment relationships in the last three decades. It can be defined as follows. The temporary agency worker is employed by the temporary work agency and, by means of a commercial contract, is hired out to perform work assignments at a user firm. This definition varies between countries only with respect to the employment status of the worker at the agency.

In this paper we develop an equilibrium unemployment model, as in temporary agency work by focusing on its role as a matching intermediary. Extensions of the Pissarides model can be found in Holmlund and Lindén (1993), where macroeconomic effects of 'relief jobs' are studied. Wasmer (1999) uses this approach to study the role of productivity growth on the emergence of fixed-term contracts. Fredriksson and Holmlund (2001), Boone and van Ours (2000), and Coe and Snower (1997) model the optimal design of unemployment benefit systems in such a flow setting. Pissarides (2001) studies the role of employment protection legislation in equilibrium unemployment. The impact of training measures and unemployment benefit sanctions are analyzed by van der Linden and Dor (2001). Mortensen (1996) evaluates training, recruiting and wage subsidies. Crowding out effects of low-educated workers on low skilled jobs by high-educated workers in Spain are modelled by Dolado et al. (2000) and Dolado et al. (2001). Fonseca et al. (2001) study the impact of start-up costs for entrepreneurs on employment levels within a matching model.

We argue that deregulation of this sector together with the widespread use of information and communication technologies helped to overcome a critical threshold level under which there were no positive revenues for temporary work agencies so that a market for agency activities emerged. Further increases in matching efficiency due to improvements in reputation and, with the ever-closer relationships between agencies and user firms, the mitigation of some coordination failure, helped to sustain the growth of agency work throughout the 1990s. Employing a search model of the labor market also allows us to study the aggregate impact of temporary work agencies. In a

calibrated version of our model, we can address policy issues such as whether temporary agency jobs crowd out other, 'regular' jobs. In this sense, we complement microstudies on transitions on the labor market that cannot give an answer as to the net aggregate effects.

Temporary work agencies are incorporated into the model by adding the state of employment in firms using temporary agency workers and the state of being in the pool of unplaced agency workers. The model is developed in section 3. Some analytical results are presented in section 4. In particular, it shows that intermediaries on the labor market will only exist if they are very efficient in placing workers to client firms. Section 5 presents a calibrated version of the model with some simulation results. The last section concludes.

However, before introducing the model it may be useful to present some basic empirical and institutional background to this novel and relatively unresearched employment relationship.

# 2 Temporary agency work

Table 1 presents the most recent available compilation of statistics on the level of temporary agency work with some degree of compatibility.[1] There it can be seen that France, with over 623,000 employees, has more agency workers than any other EU country and accounts for over 30 percent of the total. The UK is the other major contributor to the EU total. The Netherlands is the most agency work intensive country, followed by Luxembourg, France, the UK and Belgium. The intensity is low in the Austria, Germany, and the Scandinavian and Southern European countries.

Many of the characteristics of agency workers are similar to those in other temporary jobs, see for example, Booth et al. (2002), Dolado et al. (2002), and Homlund and Storrie (2002). On average agency workers are younger, less well-educated and receive lower wages and less training than workers with more permanent contractual status, see Paoli and Merllié (2001) and Storrie (2002). However, unlike the gender and economic sector distribution of fixed-term contracts, agency work in Europe is most intense among men

[1]Data on temporary agency work is generally of very poor quality. In most countries questions on agency work are not asked in the labor force survey and even when they are research indicates serious reporting errors, see for example, Burchell et al. (1999). In several EU countries the only source of information, on even the most basic statistics, emanates from the temporary work agency sector organization. However, while one should be somewhat sceptical as to the accuracy of the level of temporary agency work, and above all comparisons between countries, the rapid increase of agency work in the 1990s is indisputable.

Table 1: Temporary agency work in the European Union, 1999

| | Number of agency workers | Share of all agency workers in % | Rate of agency work in % |
|---|---|---|---|
| Austria | 24,277 | 1.2 | 0.7 |
| Belgium | 62,661 | 3.0 | 1.6 |
| Denmark | 18,369 | 0.9 | 0.7 |
| Finland | 15,000 | 0.7 | 0.6 |
| France | 623,000 | 29.9 | 2.7 |
| Germany | 243,00 | 11.7 | 0.7 |
| Greece | 0 | 0 | 0 |
| Ireland | 9,000 | 0.4 | 0.6 |
| Italy | 31,000 | 1.5 | 0.2 |
| Luxembourg | 6,065 | 0.3 | 3.5 |
| Netherlands | 305,000 | 14.7 | 4.0 |
| Portugal | 45,000 | 2.2 | 1.0 |
| Spain | 109,000 | 5.2 | 0.8 |
| Sweden | 32,000 | 1.5 | 0.8 |
| UK | 557,000 | 26.8 | 2.1 |
| EU total | 2,080,642 | 100 | 1.4 |

Source: Storrie (2002). This in turn was based on 15 national reports presented to the European Foundation for the Improvement of Working Life and Living Conditions, Dublin in 2001 and CIETT (2000).

and in industry.[2] In most countries, temporary agency work is of very short duration, even shorter than fixed-term contracts, both in terms of the assignment at the user firm and the employment spell at the agency, see Storrie (2002). While some workers express a preference for agency work, they are a clear minority, see for example Cohany (1998). The rapid increase in the 1990s must be driven by the user firms' demand for agency work and the agencies' capability to supply it.

There are a number of reasons why the firm may hire labor on a temporary basis, such as for a specific task that is limited in duration, to replace an absent permanent employee, etc., see for example Schmid and Storrie (2001). Whatever the reason, severance costs may make frequent employment contracts for a short duration unprofitable for the firm. These costs may be pecuniary (e.g. severance payments), procedural (e.g. advance notice), administrative (e.g. permission from the labor market authorities) and, given the complexity of labor law, subject to some uncertainty. One of the most prominent trends in labor law in the last two decades in Europe has been the proliferation of the circumstances for which the employer may hire labor under conditions other than those under open-ended contracts. The employment protection literature explaining the rise and consequences of "flexible" employment contracts takes relatively lower severance costs as a theoretical point of departure. See Dolado et al. (2002) for a recent review of the interesting Spanish research.

We do not address the issue of why establishments in most European countries in the last two decades have, to an increasing degree, used various forms of temporary employment contracts, but take it as a stylized fact. However, it is relevant for this paper to demonstrate that agency work may be a more appropriate means of performing the same function as temporary employment contracts.[3] The truly distinguishing feature of agency work in this context is that all severance costs are directly bourn by the agency. Of course, the user firm pays for this service, and this is a source of agency profits. However, the specialization of such functions in agencies with the potential for ensuing economies of scale, together with the potential for agencies to spread employment termination risks between various firms and sectors of the economy, may lead to lower costs through an outsourcing of these functions to the agency than for the user firms to perform them in-house. The

[2]Of course, there are some examples of higher wages and training levels in agency work than for otherwise similar directly employed persons. See Houseman et al. (2001) and Cam et al. (2002). And in Scandinavia agency work is over-represented in services and among women, see Storrie (2002).

[3]Surveys of user firms find that the motivation for using agency workers are very similar to those for fixed-term contracts. See CIETT (2000) and Cam et al. (2002).

outsourcing of some functions of the personnel department at the user firm is more obviously apparent when viewing the other, often-neglected, aspect of employment adjustment costs, i.e. recruitment. Matching is the key issue in our model and we return to why matching efficiency in agencies may have increased in the last decade in section 4.1.

There is some evidence that temporary work agencies are beginning to play a highly significant role as a matching intermediary. Katz and Krueger (1999) suggest that the rise of temporary agency work, with its potential to lower hiring costs, reduce labor market bottlenecks, and improve employment matching, may be a major contributory factor in explaining the remarkable downward shift of the Phillips curve in the US during the 1990s. In the US the stock of agency work doubled to 2.2 percent of all employment in the 1990s and Autor (2001a) ascribes 10 percent of US net employment growth during the decade to agency work. He also points out that with turnover rates in excess of 350 percent the number of hires is appreciably higher. Agency work may thus, by the turn of the century, have reached a discernible level of importance for the entire labor market. They find some empirical support for this claim by noting that the increase of temporary agency work coincided with an inward shift of the Beveridge curve. Furthermore, using cross-state regressions they find evidence that the rise of temporary work agencies in a state held down wage growth. However, they view their analysis as being "preliminary and highly speculative". Houseman et al. (2001) present some case study evidence which shows that the matching motive is an important factor behind the user firm's increasing recourse to temporary agency work. They also argue, and find some empirical support for, that the pro-cyclical variation of temporary agency work is related to the superior matching efficiency of agencies when labor markets are tight.

On the supply side, the increase in agency work in Europe is obviously related to the widespread deregulation of the sector during the 1990s, see OECD (1999) and Storrie (2002). The impact is indisputable in the countries where agency work has gone from being illegal to practically without regulation at all. This has been the case in Sweden and Finland and the changes in Italy and Spain have been almost as extensive.

There are three main means of regulating agency work. First the regulation of the sector, for example, as regards authorization and monitoring of the firms or the banning of agency work in particular industries. Second, to regulate the assignment at the user firm in a fashion similar to the restrictions placed on hiring on fixed-term contracts, for example, in terms of duration and "objective reasons". Third, the regulation of the contract at the agency where the essential matter is whether the agency worker is awarded the status of an employee or not. The US, UK, Ireland, Sweden, Finland and

Denmark have practically no regulation of the sector or assignment. However, in Scandinavia, it is clear that the worker has an employment contract at the agency, while this is not always the case in the UK and Ireland and the USA. Most of the continental European countries, in particular France, Belgium, Italy, Spain and Portugal have a detailed regulation of both the sector and the assignment.

The regulatory trend appears to be moving away from the regulation of the assignment and sector towards some employment security for the worker at the agency. This is most noticeable in the Dutch legislation, of the late 1990s, which removed practically all regulation of the assignment and the sector but clarified that the agency worker did have an employment contract at the agency, which with time gave increased employment protection, see Pot et al. (2002). The radical deregulation in Scandinavia in the mid-1990s stipulated only employment contract status. Also in the UK, a spate of legislation at the the end of the decade, while not conferring employment contract status to agency workers did extended various rights to "workers" which previously applied only to "employees" and thus encompassing many agency workers. In the US, Piore (2002) notes the tendency for agencies to voluntarily provide employment security. It is thus this type of institutional set-up that we work with in the model in this paper, i.e. with employment status for agency workers and with some degree of income security.

Finally, we should note that such an institutional set-up, i.e. the deregulation of agency work as regards assignments and the sector, while awarding employment status to agency workers may provide a step towards the solution to one of the major conflicts in European labor markets in the last two decades. It has always been assumed that the employers' demand for numerical flexibility and the workers preference for job security are irreconcilable. However, in principle, agency work can provide some employment security at the agency while providing flexible assignments at the user firm. Temporary agency work should be an important research topic in labor economics.

# 3 The model

## 3.1 Flow equilibria

We model four labor market states and corresponding flows (see figure 1). Workers can be unemployed $U$, employed on a regular job $E$, in the pool of workers of a temporary work agency $A$, or assigned to a job at a client firm $T$.

Job specific shocks occur at exogenous rates $\mu_i$ with $i = E, T, A$. If a

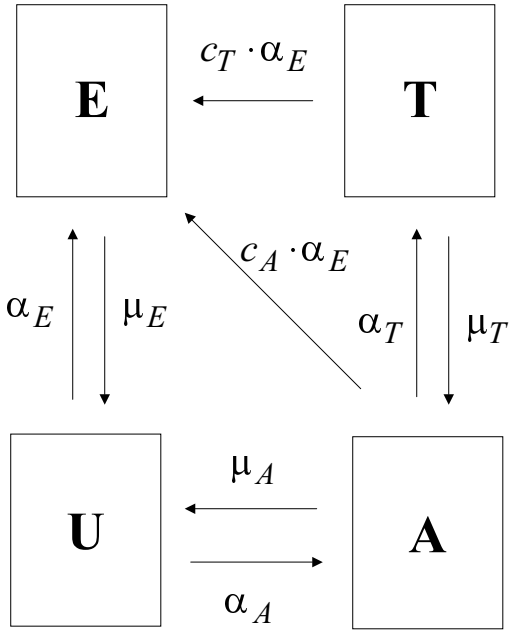


Figure 1: Labor market flows

shock hits a job in sector $E$ the worker will become unemployed. He will also become unemployed, if a shock makes jobs at the temporary work agency redundant. At a rate $\mu_T$ temporary jobs at the client firm go sour. Then our worker will end up in the pool of workers of the temporary work agency.

Job offers for regular employment arrive at an unemployed person with a rate $\alpha_E$ and at a rate of $\alpha_A$ for a temporary work agency job. We assume that workers accept the first job offer, regardless of whether it is a regular job or a job at a temporary work agency. A worker at a temporary work agency waiting for an assignment gets regular job offers at a rate $c_A \cdot \alpha_E$. A temporary work agency will find an assignment for a worker at a client firm at a rate $\alpha_T$. While assigned to a client our worker gets a job offer for regular employment with rate $c_T \cdot \alpha_E$. We call the parameters $c_A$ and $c_T$ search effectiveness by workers in states $A$ and $T$ relative to unemployed workers.

Bringing job searchers $S_i$ and vacancies $V_i$ together so that a job is formed incurs frictions. Matching workers to jobs is costly and time consuming because of heterogeneity of job searchers and vacancies. Empirical research (see Petrongolo and Pissarides (2001)) suggests a constant returns matching technology and so we assume that the matching of jobs occurs with a Cobb-Douglas function in both sectors. Hence, we have $M_i = m_i \cdot V_i^{\nu} \cdot S_i^{1-\nu}$ with

scale parameters $m_i$.

A firm that posts a vacancy in sector $E$ faces job searchers from $U$, $A$ and $T$. Taking into account different search effectiveness we have $S_E = u + c_A \cdot a + c_T \cdot t$. Temporary work agencies shall only search in the pool of unemployed workers, $S_A = u$. Furthermore, we have $S_T = a$, as temporary work agencies assign workers to client firms in $T$.

We define labor market tightness for firms in $E$, $A$ and $U$ as vacancies over job searchers, $\theta_i = \frac{V_i}{S_i}$, respectively. Any firm will fill a vacancy with a rate $q_i = \frac{M_i}{V_i} = M_i(1, \frac{1}{\theta_i})$.

The flow of new hires into the regular sector is given by $M_E = \alpha_E \cdot S_E$. Hence, the outflow from unemployment into regular jobs is the rate at which job offers occur times unemployed searchers $\alpha_E \cdot u$. The flow from unemployment to temporary work agencies is given by $\alpha_A \cdot u$. The outflow from sector $A$ into regular employment follows effective searchers in $A$ times the job offer arrival rate, $c_A \cdot a \cdot \alpha_E$. The flow of assignments is $\alpha_T \cdot a$. Hires into regular employment from temporary work are $c_T \cdot \alpha_E \cdot t$. Note that job offer arrival rates can also be written as $\alpha_i = \frac{M_i}{V_i} \cdot \frac{V_i}{S_i} = q_i \cdot \theta_i$ with $i = E, A, T$.

The vacancy filling rate declines with labor market tightness $q_i'(\theta_i) < 0$. The job offer arrival rates increases in labor market tightness $\alpha_i'(\theta_i) > 0$.

We normalize the size of the labor force to one ($e + a + t + u = 1$), assuming that labor force growth is zero. Stocks of each labor market state will be constant if inflows equal outflows. Hence, the flow equilibria are determined by the following four equations:

$$\alpha_E \cdot u + c_A \cdot \alpha_E \cdot a + c_T \cdot \alpha_E \cdot t = \mu_E \cdot e \tag{1}$$

$$\mu_E \cdot e + \mu_A \cdot a = \alpha_E \cdot u + \alpha_A \cdot u \tag{2}$$

$$\alpha_A \cdot u + \mu_T \cdot t = \mu_A \cdot a + c_A \cdot \alpha_E \cdot a + \alpha_T \cdot a \tag{3}$$

$$\alpha_T \cdot a = c_T \cdot \alpha_E \cdot t + \mu_T \cdot t, \tag{4}$$

respectively.

## 3.2 Labor demand

Let $J_{E,V}$ be the present discounted value of the expected profits of a vacant regular job and $r$ the interest rate. The per time unit costs of a vacant job $r \cdot J_{E,V}$ must equal the expected return within that time unit $t$. The hiring costs per time unit shall be $k_E$. The rate at which a job is filled is $q_E$. The excess value of a filled job is $(J_{E,F} - J_{E,V})$, with $J_{E,F}$ as the present discounted

value of expected profits from a filled regular job. Hence, the value function for a vacant job in sector $E$ can be written as

$$r \cdot J_{E,V} = -k_E + q_E \cdot (J_{E,F} - J_{E,V}). \tag{5}$$

The free entry condition implies that firms exploit all the profit opportunities available by posting a vacancy and thus the value of a vacant job in equilibrium is zero. Under the assumption of free entry, equation (5) becomes $J_{E,F} = \frac{k_E}{q_E}$. As $q_E$ is the expected duration of a vacancy, the latter states that in equilibrium the supply of jobs is such that the expected costs of a vacancy equal the expected discounted profits of a filled job.

A firm $i$ earns $y$ with a regular job per time unit, and has wage costs $w_i$ and faces the risk that the job becomes unproductive with probability $\mu_E$ which diminishes returns by $J_{E,F,i} - J_{E,V}$. We furthermore assume that if the job becomes unproductive and the worker has to leave the firm, severance payments $s$ accrue. Hence, the value function for a filled job writes:

$$r \cdot J_{E,F,i} = y - w_i - \mu_E \cdot (J_{E,F,i} - J_{E,V}) - \mu_E \cdot s. \tag{6}$$

Let firms be small compared to the economy. In that case, the bargained wage at each firm $i$ will have no impact on the wage level in the economy, so that in equilibrium the wage at firm $i$ is equal to the economy wide wage $w$. Then, regular job creation, which corresponds to a marginal condition for labor demand, follows from equations (5), (6), and $J_{E,V} = 0$ as

$$\frac{k_E}{q_E} = \frac{y - w - \mu_E \cdot s}{r + \mu_E}. \tag{7}$$

Labor demand for regular jobs in sector $E$ is such that the expected costs of a vacancy, the left hand side of equation (7), equal expected discounted returns from a filled job. If there were no costs for posting a vacancy ($k_E = 0$) and no severance payments, the usual condition would hold with the marginal return equal to the wage. As $q'_E(\theta_E) < 0$ labor demand is downward sloping in the wage tightness space, although the production technology has constant returns.

Firms may also open a vacancy for a temporary worker. We denote these jobs $T$. The costs of opening such a vacancy per time unit are $k_T$. The firm can fill the vacancy with a worker borrowed from a temporary work agency at the rate $q_T$. We assume that productivity on temporary jobs is the same as on regular jobs. The wage costs for the client firm shall be $\sigma \cdot w$. This means that client firms pay a mark-up $(\sigma - 1)$ on the wage $w$ that is paid to workers on a regular job. The value equations for temporary jobs become

$$r \cdot J_{T,V} = -k_T + q_T \cdot (J_{T,F} - J_{T,V}). \tag{8}$$

for the vacancy and

$$r \cdot J_{T,F} = y - \sigma \cdot w - \mu_T \cdot (J_{T,F} - J_{T,V}) - c_T \cdot \alpha_E \cdot (J_{T,F} - J_{T,V}) \quad (9)$$

for the filled job. With free entry to the market ($J_{T,V} = 0$) the marginal condition for labor demand for temporary workers is

$$\frac{k_T}{q_T} = \frac{y - \sigma \cdot w}{r + \mu_T + c_T \cdot \alpha_E}. \quad (10)$$

Finally, let us turn to labor demand of temporary work agencies. They hire workers from the pool of unemployment. If a temporary work agency finds a worker the vacancy gets filled. We denote that state with $F$. However, the job is unproductive until the temporary agency finds a client firm to lend out the worker. That state will be denoted with $P$. The value functions from which the temporary work agencies' demand for labor follows are thus:

$$r \cdot J_{A,V} = -k_A + q_A \cdot (J_{A,F} - J_{A,V}), \quad (11)$$

$$\begin{aligned} r \cdot J_{A,F} = &- f + \alpha_T \cdot (J_{A,P} - J_{A,F}) - \\ &\mu_A \cdot (J_{A,F} - J_{A,V}) - c_A \cdot \alpha_E \cdot (J_{A,F} - J_{A,V}), \end{aligned} \quad (12)$$

and

$$\begin{aligned} r \cdot J_{A,P} = &\sigma \cdot w - \delta \cdot w - \\ &\mu_T \cdot (J_{A,P} - J_{A,F}) - c_T \cdot \alpha_E \cdot (J_{A,P} - J_{A,V}). \end{aligned} \quad (13)$$

Again, the expected per time unit returns to a vacant job have to equal the per time unit opportunity cost $r \cdot J_{A,V}$. The expected returns are comprised of the additional value $J_{A,F} - J_{A,V}$ when a vacancy can be filled with probability $q_A$ minus the costs of opening a vacancy denoted by $k_A$. The returns of having an idle worker in the pool to be assigned consist of a retainer fee $f$ that is paid to the worker, the value of a productive job over an idle job times the probability that the worker can be assigned, and losses that accrue if the unproductive job goes sour or if the worker finds a regular job. A filled and productive job brings in $\sigma \cdot w$ to the temporary work agency. That is the fee the client firm has to pay for borrowing the worker. The worker himself gets $\delta \cdot w$ from the temporary work agency. Per time unit returns are also diminished for the temporary work agency if the assignment at the client firm goes sour with probability $\mu_T$. We assume that in this case the worker returns to the temporary work agency, for example because of a synchronization ban imposed on agencies. The worker is unproductive then, waiting for another assignment. The last term on the right hand side reflects the transition of a

temporary worker assigned to a client firm to a regular job which happens with a rate $c_T \cdot \alpha_E$. In this case, the job at the temporary work agency becomes vacant. The temporary work agency looses $J_{A,P} - J_{A,V}$.

The parameter $\delta$ which determines the income of an assigned temporary agency worker as a fraction of the wage on a regular job and the retainer fee $f$ are elaborated more closely in the following section.

Right now, let us state what follows from the value functions for labor demand from temporary work agencies. Free entry implies $J_{A,V} = 0$. Equations (11), (12), (13) and the free entry condition yield the marginal condition for labor demand of temporary work agencies as

$$\frac{k_A}{q_A} = \frac{\alpha_T \cdot (\sigma - \delta) \cdot w - (r + \mu_T + c_T \cdot \alpha_E) \cdot f}{(r + \mu_T + c_T \cdot \alpha_E)(r + \alpha_T + \mu_A + c_A \cdot \alpha_E) - \alpha_T \cdot \mu_T}. \tag{14}$$

Note that $J_{A,P} = 1/\alpha_T \cdot (J_{A,F} \cdot (r + \alpha_T + \mu_A + c_A \cdot \alpha_E) + f)$ from which follows that the net return of a productive job is always larger than the returns from a filled job ($J_{A,P} > J_{A,F}$) where the worker could so far not be assigned to a client firm.

We assume that temporary work agencies will charge fees to the client firm for lending out a worker such that expected profits from 'temp' jobs and regular jobs equalize.[4] Hence, temporary work agencies will choose a $\sigma$ such that $(y - w - \mu_E \cdot s)/(r + \mu_e) = (y - \sigma \cdot w)/(r + \mu_T + c_T \cdot \alpha_E)$. Rewriting that conditions gives $\sigma$ as

$$\sigma^* = \frac{1}{w} \cdot (y - \frac{r + \mu_T + c_T \cdot \alpha_E}{r + \mu_E} \cdot (y - w - \mu_E \cdot s)). \tag{15}$$

## 3.3 Value functions for workers

Denote $\psi_E$, $\psi_T$, $\psi_A$, and $\psi_U$, as the present discounted value of the expected income stream of having a regular job $E$, of being assigned by a temporary work agency to a client firm, being in the pool of a temporary work agency, and being unemployed, respectively. Interpreting the present discounted values as assets, then in equilibrium every asset has to give a return per time unit equal to the capital market yield at the interest rate $r$. Thus, the return per time unit for a regularly employed individual $i$ can be written as

$$r \cdot \psi_{E,i} = w_i - \mu_E \cdot (\psi_{E,i} - \psi_U) + \mu_E \cdot s. \tag{16}$$

[4]Note, that this assumption is very much in the spirit of Dolado et al. (2000) who determine training costs for low skilled workers to be employed on less productive jobs in a matching model in such a way.

When being regularly employed, the individual earns a wage $w_i$ per time unit. At a rate $\mu_E$ he looses his job and becomes unemployed. This amounts to a value loss of $\psi_{E,i} - \psi_U$. However, the worker receives severance payments $s$.

The value function for the state of unemployment can be written as

$$r \cdot \psi_U = b + \alpha_E \cdot (\psi_E - \psi_U) + \alpha_A \cdot (\psi_A - \psi_U). \tag{17}$$

The left hand side of equation (17) can be interpreted as the reservation wage of an unemployed worker as it is the minimum income that has to be paid so that he will give up search. The first term on the right hand side, $b$, is the per time unit income from unemployment.[5] While being unemployed the worker will move to employment in sector $E$ with rate $\alpha_E$ and gain $\psi_E - \psi_U$. He may also get a job at a temporary work agency at a rate $\alpha_A$ which would raise income by $\psi_A - \psi_U$.

The value function for a worker at a temporary work agency is

$$r \cdot \psi_A = f + \alpha_T \cdot (\psi_T - \psi_A) + c_A \cdot \alpha_E \cdot (\psi_E - \psi_A) - \mu_A \cdot (\psi_A - \psi_U). \tag{18}$$

Workers in sector $A$ receive a retainer fee $f$ for being in the pool of a temporary work agency. They are idle, waiting to be assigned to a productive job at a client firm by the temporary work agency. With probability $\alpha_T$ they are assigned to a client and become productive. Workers in sector $A$ find a job in sector $E$ with probability $c_A \cdot \alpha_E$ which yields additional value of $\psi_E - \psi_A$. Unproductive jobs at temporary work agencies on which workers wait to be assigned are destroyed at rate $\mu_A$ which yields a loss of $\psi_A - \psi_U$.

While being assigned to a client firm the worker receives a fraction $\delta$ of the wage $w$ that is paid for regular jobs, finds a regular job at a rate $c_T \cdot \alpha_E$, and looses his assignment with probability $\mu_T$. Hence, the value function for an assigned worker is

$$r \cdot \psi_T = \delta \cdot w - \mu_T \cdot (\psi_T - \psi_A) + c_T \cdot \alpha_E \cdot (\psi_E - \psi_T). \tag{19}$$

Incentive compatibility requires that the present discounted expected value for a worker employed in sector $E$ is larger than the value as a temporary worker and equal or greater than the value of being unemployed $\psi_E > \psi_A \geq \psi_T \geq \psi_U$.

[5]For simplicity we do not make the income from unemployment dependent on past wages. If income from unemployment was dependent on wages two complications would arise. First, unemployed workers, no matter whether they lost a regular job or a job at a temporary work agency, would receive the same fraction of $w$. This is clearly contrary to most unemployment benefit systems where latter are tied to the latest income achieved. Second, workers would have different outside options in wage bargaining depending on their employment record. They would bargain for different wages even if jobs are the same. The latter remark was already made in Wasmer (1999).

Certainly a temporary work agency will be interested to keep the costs for workers as low as possible. If we assume, that all the unemployed workers are powerless vis à vis temporary work agencies, we may postulate that temporary work agencies offer retainer fees $f$ and wages $\delta \cdot w$ which make their workers at the margin indifferent between working at a temporary work agency and staying unemployed ($\psi_T = \psi_A = \psi_U$). Admittedly, this is a strong assumption. But it simplifies the analytical framework strikingly.[6] Furthermore, evidence on workers at temporary work agencies suggests that those workers are hardly organized (Storrie (2002)) having a poor bargaining position. If we employ the assumption of very powerful temporary work agencies that unilaterally can decide on the income of their employees, the value equations become

$$r \cdot \psi_{E,i} = w_i - \mu_E \cdot (\psi_{E,i} - \psi_U) + \mu_E \cdot s \tag{20}$$

$$r \cdot \psi_U = b + \alpha_E \cdot (\psi_E - \psi_U) \tag{21}$$

$$r \cdot \psi_A = f^* + c_A \cdot \alpha_E \cdot (\psi_E - \psi_A) \tag{22}$$

$$r \cdot \psi_T = \delta^* \cdot w + c_T \cdot \alpha_E \cdot (\psi_E - \psi_T) \tag{23}$$

with

$$f^* = b + \alpha_E \cdot (1 - c_A) \frac{w + \mu_E \cdot s - b}{r + \mu_E + \alpha_E} \tag{24}$$

and

$$\delta^* = \frac{1}{w}(w + \mu_E \cdot s - (r + \mu_E + c_T \cdot \alpha_E) \frac{w + \mu_E \cdot s - b}{r + \mu_E + \alpha_E}). \tag{25}$$

If idle temporary agency workers are as effective searchers as unemployed workers, temporary work agencies pay a retainer fee $f^*$ that equals income from unemployment. If those workers were more effective in searching for a regular job than unemployed workers, temporary work agencies would offer a retainer fee lower than income from unemployment to make their employees as equally well off as unemployed workers, and for less effective searching temporary work agencies offer a higher retainer fee than income from unemployment. Note also, that if $c_T = 1$, alas assigned temporary agency workers are as effective searchers as unemployed workers, equation (25) tells that $\delta^* = b/w$. This implies that assigned worker earn $\delta^* \cdot w = b$. Making use of the wage equation (which is developed in the next section, see equation (29)), it is possible to show that the income of assigned workers is smaller

[6] For example, Dolado et al. (2000) assume in a matching model with skilled and unskilled workers and jobs, that wages in the unskilled sector are such that they equal the reservation wage of workers.

than income from unemployment ($\delta^* \cdot w < b$) if $c_T > 1$ and $\delta^* \cdot w > b$ if $0 < c_T < 1$. Thus, if an assigned worker profits from having a higher search effectiveness than an unemployed worker, the temporary work agency will reap the benefits from that by increasing the mark-down on wages paid in regular jobs. If the temporary agency worker's search effectiveness suffers from being assigned ($c_T < 1$), then the temporary work agency has to decrease the mark-down, so that income from a job as a 'temp' becomes higher than income from unemployment. Otherwise, the worker would not like to take up a job at a temporary work agency.

Under the equilibrium assumption all firms pay a wage $w$. Then, the present discounted value of an employed worker becomes $\psi_E$ instead of $\psi_{E,i}$. Solving the value functions of the workers for the difference in the present discounted values between being employed and unemployed yields

$$\psi_E - \psi_U = \frac{w + \mu_E \cdot s - b}{r + \alpha_E + \mu_E}. \tag{26}$$

Note that for sufficiently low $b's$, incentive compatibility is always fulfilled.

## 3.4 Wages

Wages on regular jobs shall be determined by Nash bargaining. Usually it is assumed that firms are small relative to the economy so that the bargained wage $w_i$ between a worker and a firm has no impact on the equilibrium wage $w$. The threat point on the side of the workers is the value of being unemployed $\psi_U$ and for the firm it is the value of a vacant job $J_{E,V}$. The wage from Nash bargaining is the solution of the weighted product that maximizes the net return for a worker and a firm of a filled job

$$\max_{w_i} \Omega_i = (\psi_{E,i} - \psi_U)^{\beta} \cdot (J_{E,F,i} - J_{E,V})^{1-\beta}. \tag{27}$$

With the free entry condition the value of a vacancy becomes zero ($J_{E,V} = 0$). Furthermore, the value of being unemployed is independent from $w_i$. Hence, the first order condition is

$$\beta \cdot J_{E,F,i} \cdot \frac{\partial \psi_{E,i}}{\partial w_i} = (\beta - 1)(\psi_{E,i} - \psi_U)\frac{\partial J_{E,F,i}}{\partial w_i}. \tag{28}$$

Under the equilibrium assumption we get the wage setting curve by inserting $\psi_E - \psi_U$ from (26) and $J_E$ from (6) into equation (28) as

$$w = \frac{\beta}{1-\beta} \cdot \frac{k_E}{q_E} \cdot (r + \mu_E + \alpha_E) - \mu_E \cdot s + b. \tag{29}$$

The wage setting equation closes the model. It gives the bargained wage as a function of labor market tightness $\theta_E$. As the job arrival rate $\alpha_E(\theta_E)$ is increasing in market tightness, and the vacancy filling rate for regular jobs ($q_E = q_E(\theta_E)$) is decreasing in market tightness, and $\beta/(1-\beta) > 0$ the wage setting curve is upward sloping.

The model solves recursively. To see this in the most obvious way let us restate the necessary equations here:

$$w = \frac{\beta}{1-\beta} \cdot \frac{k_E}{q_E} \cdot (r + \mu_E + \alpha_E) - \mu_E \cdot s + b \tag{30}$$

$$\frac{k_E}{q_E} = \frac{y - w - \mu_E \cdot s}{r + \mu_E} \tag{31}$$

$$\sigma^* = \frac{1}{w} \cdot (y - \frac{r + \mu_T + c_T \cdot \alpha_E}{r + \mu_E} \cdot (y - w - \mu_E \cdot s)) \tag{32}$$

$$\frac{k_T}{q_T} = \frac{y - \sigma^* \cdot w}{r + \mu_T + c_T \cdot \alpha_E} \tag{33}$$

$$f^* = b + \alpha_E \cdot (1 - c_A) \frac{w + \mu_E \cdot s - b}{r + \mu_E + \alpha_E} \tag{34}$$

$$\delta^* = \frac{1}{w}(w + \mu_E \cdot s - (r + \mu_E + c_T \cdot \alpha_E) \frac{w + \mu_E \cdot s - b}{r + \mu_E + \alpha_E}) \tag{35}$$

$$\frac{k_A}{q_A} = \frac{\alpha_T \cdot (\sigma^* - \delta^*) \cdot w - (r + \mu_T + c_T \cdot \alpha_E) \cdot f^*}{(r + \mu_T + c_T \cdot \alpha_E)(r + \alpha_T + \mu_A + c_A \cdot \alpha_E) - \alpha_T \cdot \mu_T}. \tag{36}$$

The wage setting curve (30) and the labor demand curve (31) for regular jobs in sector $E$ give the bargained wage $w$ and labor market tightness $\theta_E$. Then, one can solve for $\sigma^*$ using equation (32). The marginal condition for the demand for temporary jobs (33) gives labor market tightness $\theta_T$. Equations (34) and (35) determine the retainer fee $f^*$ and the fraction $\delta^*$ of the wage on regular jobs that temporary workers receive, respectively. In a next step, one can use equation (36) to solve for labor market tightness in $A$. Finally, inserting $\theta_E$, $\theta_A$, and $\theta_U$ in the flow conditions ((1) to (4)) gives the equilibrium rate of unemployment $u$, regular employment $e$, assignments $t$, and idle labor $a$ at temporary work agencies.

# 4 Analytical results

## 4.1 The emergence of temporary work agencies

We already established that the wage setting schedule is upward sloping and labor demand for regular jobs is downward sloping in the real wage

tightness space. Pissarides (2000) shows that there exists an equilibrium in a model with one type of job ($E$). Now, we will explore under what conditions temporary work agencies will come into existence. Formally, whether there is a labor market tightness $\theta_A > 0$.

**Proposition 1** *There is always a positive labor market tightness $\theta_T$. For sufficiently high matching efficiency $m_T$, labor market tightness $\theta_A$ will be positive.*

The proposition states that one will observe temporary work agencies as intermediaries on the labor market if they are sufficiently good in assigning workers to client firms.

**Proof 1** *Under the assumption of equal net returns for firms in $E$ and $T$, the left hand side of equation (33) is always positive which implies a positive $\theta_T$.*

*From equation (36) follows that there is a positive $\theta_A$ if the net returns from having an unproductive job (a filled vacancy with an idle worker to be assigned) are positive for a temporary work agency. The denominator of (36) is always positive. Hence, one will observe a positive $\theta_A$ if*

$$\alpha_T > f \cdot \frac{r + \mu_T + c_T \cdot \alpha_E}{(\sigma^* - \delta^*) \cdot w}. \tag{37}$$

*The right hand side of this inequality is a function of labor market tightness in $E$ only. Also observe, that the parameter $m_T$ does not show up on the right hand side, but only in $\alpha_T$. Under the assumption of equal present discounted expected profits we can take labor demand equations (31) and (33) and solve for the vacancy filling rate in $T$*

$$q_T = \frac{k_T}{k_E} \cdot q_E. \tag{38}$$

*The wage setting schedule and labor demand for $E$ determine $\theta_E$ and therefore the right hand side of equation (38). Say that a set of parameters $\{\beta, k_E, \mu_E, m_E, s, b, k_T, r, y\}$ yields a vacancy filling rate $\bar{q}_T$ following equation (38). The properties of the vacancy filling rate $q_T$ are such that a combination of $\{\bar{m}_T, \bar{\theta}_T\}$ will yield $\bar{q}_T$ as well as a combination $\{\tilde{m}_T, \tilde{\theta}_T\}$ with $\tilde{m}_T > \bar{m}_T$ and $\tilde{\theta}_T > \bar{\theta}_T$. As the job arrival rate $\alpha_T$ is increasing in $m_T$ and $\theta_T$, one can always find a sufficiently high matching scale parameter $m_T$ so that condition (37) is satisfied.*

Thus in our model the emergence and growth of temporary agency work is due to an upward shift in the matching efficiency parameter $m_T$. The

question is why this may have occurred? In many European countries one of the key factors is almost certainly the de-regulation of the sector, which was sketched in section 2. The impact of deregulation in Scandinavia, in particular, where it went from being in practice illegal to almost without regulation at all must be viewed as indisputably a necessary condition for the rapid growth there in the latter part of the decade. De-regulation was also extensive in Spain and Italy, and also in most other EU counties the general trend has been of de-regulation. As de-regulation increases the opportunity for agencies to perform matching activities, it is certainly one of the obvious candidates to enable the emergence and growth of agency work in the 1990s in Europe.

It was argued in section 2 that the characteristic feature of agency work was the outsourcing of the recruitment function to the intermediary, i.e. the agency which performs the matching function for the firm. Matching on the labour market is one of the classic examples of exchange under asymmetric information, see Spence (1973), and is often phrased in terms of job searchers having more information of their capabilities and effort levels than the firm. In this situation an intermediary can reduce the uncertainty facing the firm as the agency will have the incentive to accurately report the quality of their workers to the user firm in order to build and maintain their reputation. The agency will be more concerned with reputation than a single job searcher as the agency has a greater number of possible future transactions. Furthermore, as the agency specialises in recruitment, i.e. search, screening and possibly training, this specialisation will probably imply that an agency will recruit more workers than a typical user firm and thus may exploit economies of scale, see Autor (2001b). In the case of a temporary work agency, the uncertainty to the user firm is further diminished by the fact that, unlike a recruitment agency, the user firm does not need to adopt any employment risk and indeed a guarantee of quality may even be stipulated explicitly in the commercial contract between the agency and the user firm for the duration of the assignment.

The issue of reputation has obviously been of great importance to agencies as the improvement of reputation has been a very prominent strategy of many agency companies in the last decade and several companies, such as Manpower and Randstad, have now become recognizable brand names. This is almost certainly related to the two factors mentioned above, i.e. the information role played by agencies and the recent legal history of agency work. Prior to de-regulation, when agencies operated often in a legal grey zone, reputation was in many cases very low and many were associated with shady practices. They have sought to build reputation with both potential employees and user firms by means of ethical codes of practice, advertising

campaigns and the signing of collective agreements, see Storrie (2002). Reputation building is costly and the knowledge that such investment has been made may further convince user firms of agencies commitment to quality. Furthermore, the agency sector has undergone considerable market consolidation during the 1990s. According to CIETT (2000), by 1998 the top five temporary work agencies accounted for over fifty per cent of turnover in eleven of the fourteen Member States where agency work exists. This process may have further served to push out some of the smaller and less reputable agencies. Improved reputation has presumably served to improve the matching efficiency of temporary work agencies in that they are able to attract better job applicants and to gain acceptance of agency worker with the personnel departments and the trade unions at the client firm.

Petrongolo and Pissarides (2001) note that technological advances can shift the matching parameter upwards. The rapid growth of agency work since the beginning of the 1990s coincided with the widespread introduction of information and communication technology (ICT). Internet job sites are able to contain appreciably more vacancy and job searcher information at much lower cost than, for example, newspapers. However, this technology by no means implies that there will be an increase in the direct contact between the firm and job searchers without going through a matching intermediary. The fact that the technology significantly lowers the cost for the job seeker to apply for jobs may lead to employers being inundated with applications. Thus, as argued in Autor (2001b), intermediaries such as, temporary work agencies are required to reap the benefits of the computerized matching technologies. Furthermore, the role of intermediaries for providing high quality information is a much-researched issue in the E-commerce literature, see Malone et al. (1987) and Sarkar et al. (1995), which stresses economies of scale and scope and the reputation issue mentioned above. Thus the idea here is that ICT has the potential to increase matching efficiency. However, this potential can only be fully realized if it is exploited by matching intermediaries such as temporary work agencies.

Coordination failures, i.e the uncoordinated action of firms and workers, are according to Petrongolo and Pissarides (2001) potentially a major source of matching inefficiency. Just as the Business and Industrial Organisation literature has observed how supply and user firms coordinate their activities, there is evidence of increased coordination between agency and user firms. Indeed, Belkacem (1998), in a comparative study of France and Germany, compared the agency user firm relationship with other sub-contractors of the user firm. Macaire and Michon (2001) find that agency work is becoming more integrated into management systems of the user undertakings and is thus much more than a one-off measure to cope with unexpected situations.

Table 2: Comparative static results

| | w | $\theta_E$ | $\theta_T$ | $\theta_A$ | e | a | t | u |
|---|---|---|---|---|---|---|---|---|
| $m_A$ | 0 | 0 | 0 | + | | | | |
| $m_T$ | 0 | 0 | + | | | | | |
| $m_E$ | | | | | | | | |
| $c_T$ | 0 | 0 | 0 | | | | | |
| $k_A$ | 0 | 0 | 0 | − | | | | |
| $k_T$ | 0 | 0 | − | | | | | |
| $k_E$ | | − | | | | | | |
| $\mu_T$ | 0 | 0 | + | − | | | | |
| $\mu_E$ | | | | | | | | |
| $\beta$ | + | − | − | | | | | |
| b | + | − | − | | | | | |
| s | − | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Thus, as temporary work agencies build up business relationships with their user firms and better understand their labor requirements, they may be more able to avoid coordination failure. This is a process that takes time and may be related to learning-by-doing. The learning process of agencies may also be related to sectors or regions as empirically illustrated for France in Lefevre et al. (2001))

Thus, the explanation for greater increased matching efficiency in temporary work agencies is thus that with de-regulation agencies were able to devote themselves to these activities, in some countries, for the first time and in others more easily. After de-regulation the agencies were able to build upon their reputation in order to attract workers and client firms. Reputation is also a vital factor in convincing the user firm that the agency will provide it with correct information on worker capabilities. As the agency becomes more like a supply firm, the closer relations between the agency and the user firm serve to reduce coordination failure. The learning-by-doing process also may apply to sectors and locations. There are thus a number of reasons why matching efficiency may have increased in the 1990s and of course we cannot distinguish between these various possibilities.

## 4.2 Comparative static results

Besides the emergence condition for temporary work agencies as intermediaries on the labor market, we can establish some comparative static results

from our model (see table 2). Increasing the labor share in wage bargaining ($\beta$) turns the wage setting curve anti-clockwise (cf. (30)). As labor demand in the regular sector does not shift (see equation (31)), this yields a higher wage for regular jobs and a less tight market for firms in $E$. As $\theta_E$ decreases so has labor market tightness for firms in $T$. This follows from the fact that temporary work agencies will charge a $\sigma$ that makes present expected profits for jobs in $E$ and $T$ equal. Under the zero profit condition this implies equal average hiring costs which drives the decrease of $\theta_T$ as $\theta_E$ drops.

Higher income from unemployment ($b$) shifts the wage setting curve upward. A change in $b$ does not have an impact on labor demand. Therefore, wages in regular jobs increase and labor market tightness for firms in sector $E$ declines. Furthermore, one observes a decrease in labor market tightness for firms opening a vacancy in $T$.

Larger severance payments move the wage setting curve downwards. Labor demand shifts also down. Hence, wages are lower. Eliminating the wage from equations (30) and (31) yields that labor market tightness in $E$ is not affected by changes in severance payments. This is a result that has also been discussed in Burda (1992). As net returns are not affected by changes in the severance payments, there is also no change in labor market tightness for firms in $T$. This follows from the reasoning sketched above, namely that average hiring costs have to be equal between $E$ and $T$. That tightness $\theta_A$ is unaffected can be seen from inserting $f^*$, $\sigma^*$, $\delta^*$ and $w$ into the right hand side of equation (36) which leaves it unchanged if severance payments should alter. Finally, from the flow conditions it is observable that the employment structure, $e$, $a$, $t$, and unemployment $u$ are not affected by changes in severance payments.

Raising the costs for opening a vacancy in $E$ turns the wage setting curve anti-clockwise. In addition labor demand becomes steeper. Therefore, the composite impact on the wage level is ambiguous. Labor market tightness for firms in $E$ decreases, inducing an increase in the vacancy filling rate. Thus, the impact on average hiring costs is ambiguous, too.

Increasing the per time unit hiring cost ($k_T$) for firms hiring from temporary work agencies has no impact on wages and labor market tightness $\theta_E$. Under the equal expected returns constraint, it follows from equation (33) that the vacancy filling rate $q_T$ has to rise. This brings a drop in labor market tightness $\theta_T$. The impact on $\theta_A$ is ambiguous.

If per time unit costs of hiring into the pool of temporary work agencies rise, this will only bring about a drop in labor market tightness $\theta_A$. This follows from equation (36).

A higher job destruction rate for jobs in sector $E$ shifts the wage setting curve down and turns it anti-clockwise. Labor demand also shifts down and

becomes steeper. Hence, wages will be lower. The impact on labor market tightness for firms in sector $E$ is ambiguous.

If jobs in $T$ go sour at a higher rate wages $w$ and $\theta_E$ are not affected. Inserting $\sigma^*$ into the right hand side of equation (33) shows that average hiring costs for $T$ are independent from the job destruction rate $\mu_T$. Hence, labor market tightness $\theta_T$ will be unaffected. The right hand side of equation (36) becomes smaller which brings about a rise in the vacancy filling rate for $A$. Consequently labor market tightness $\theta_A$ has to fall.

If search effectiveness of assigned 'temps' is raised, one will not observe any impact on wages, and labor market tightness $\theta_E$ and $\theta_T$.

There are no unambiguous results that could be reported for changes in the matching scale parameter for sector $E$. However, an increase of $m_T$ raises labor market tightness in $T$, while it leaves wages and $\theta_E$ unaffected. A change in the scale parameter for matches of unemployed workers and vacancies posted by temporary work agencies, $m_A$, raises labor market tightness $\theta_A$ but does not change, $w$, $\theta_E$, and $\theta_T$.

# 5 Calibration and labor market policy analysis

As a number of results are ambiguous, especially as regards the impact of parameter changes on the employment and unemployment rates, we conduct a numerical exercise (see table 3 for a summary of the baseline parameters chosen). The time unit for the calibration is a quarter of a year. We normalize job productivity $y$ to 1. The quarterly real interest rate $r$ is set equal to 0.0125. Regular jobs and jobs in $T$ shall go sour at a rate of $\mu_E = 0.05$. That implies an average duration of a job in $E$ of five years which mirrors the findings in Auer and Cazes (2000). We assume that the job separation rate for the non-regular jobs is higher and set $\mu_A = 0.3$. The per time unit costs of hiring on a regular job $k_E = 1.2$ shall be larger than the costs for hiring from a temporary work agency ($k_T = 1$). This yields average expected hiring costs in $E$ in the baseline model, where the rate at which vacancies are filled is 2.1, of roughly half of the labor productivity. Average expected hiring costs for jobs in $T$ are the same (due to the fact that temporary agencies charge a mark-up on the wage to the client firms to make expected profits in $E$ and $T$ equal). The per time unit costs of hiring for temporary work agencies shall be $k_A = 5$. With a vacancy filling rate $q_A = 27.3$, average vacancy filling costs of temporary work agencies are roughly a third of those in $E$. We set the bargaining strength parameter equal to 0.6 which is in the range

that Fredriksson and Holmlund (2001) choose. Income from unemployment amounts to $b = 0.5$ so that in the baseline simulation income from unemployment becomes about 82% of the wage. Given net replacement rates for OECD economies of up to 70% and considering a broader interpretation of income from unemployment, e.g. by taking into account non-market activity, the value seems to be justified. Following the survey on matching functions by Petrongolo and Pissarides (2001), where it is suggested that the matching elasticity with respect to unemployment lies somewhere between 0.5 and 0.7, we set $\nu = 0.5$. We take for the scale parameters of the matching function in $E$ $m_E = 1$. The residual scale parameter for matches between temporary work agencies and client firms is adjusted to meet the emergence condition for temporary work agencies as it was derived before (with baseline parameter values the expected returns for temporary work agencies become positive at a matching scale parameter of $m_T \approx 1.58$). The scale parameter $m_A$ was increased hand in hand with $m_T$ as temporary work agencies will very likely not only be more efficient in placing workers but also in drawing them from the pool of unemployed. Relative search effectiveness for workers in the agency pool is set equal to that of an unemployed worker. For this purpose we may assume that the positive effect of being screened by the temporary work agency and a possibly negative effect on search effectiveness due to less time for searching on $c_A$ cancel out. We set relative search effectiveness of assigned workers $c_T = 1.1$. Thus, we believe that being assigned has a very strong and positive signalling effect for a worker in $T$. In addition, he may have better information on vacancies than unemployed workers. Both effects may outweigh a negative impact on $c_T$ through less time for search. In the baseline model we get an employment rate of 90.7%, an unemployment rate of 6.6%, and a share of temporary work in the labor force of 2.7%. With respect to total employment, the share of temporary work is 2.9%. Labor market tightness for firms in $E$ is such that for every vacancy posted there are about five job searchers. This is roughly the size that Beveridge curves of industrialized countries yield (see Jackman et al. (1990) or OECD (2001)). Firms in $A$ face about 120 job searchers for every vacancy posted. In $T$ the size is about one to two. The vacancy filling rate for firms in $E$ is $q_E = 2.1$. Hence, vacancies are filled on average after six weeks. The client firm of a temporary work agency expects to wait slightly longer before the temporary worker arrives at its plant. In our baseline calibration, the average duration of unemployment ($1/\alpha_E$) before workers find a regular job is 25 weeks. Again, this is in line with unemployment durations studies. Adding the exit from unemployment to a temporary work agency, the expected duration of unemployment decreases to 17 weeks. Wages $w$ are 61% of labor productivity. The retainer fee equals income from unemployment. When employed

Table 3: Baseline parameter values, quarterly calibration

| | |
|---|---|
| Job productivity | $y = 1$ |
| Real interest rate | r=0.0125 |
| Productivity shock frequency for firms in $E$ | $\mu_E = 0.05$ |
| Productivity shock frequency for firms in $A$ | $\mu_A = 0.3$ |
| Productivity shock frequency for firms in $T$ | $\mu_T = 0.05$ |
| Per time unit hiring cost in $E$ | $k_E = 1.2$ |
| Per time unit hiring cost in $A$ | $k_A = 5$ |
| Per time unit hiring cost in $T$ | $k_T = 1$ |
| Workers' rent share | $\beta = 0.6$ |
| Income from unemployment | $b = 0.5$ |
| Matching elasticity | $\nu = 0.5$ |
| Matching scale factor for $E$ | $m_E = 1$ |
| Matching scale factor for $A$ | $m_A = 2.5$ |
| Matching scale factor for $T$ | $m_T = 2.5$ |
| Relative search effectiveness from $A$ | $c_A = 1$ |
| Relative search effectiveness from $T$ | $c_T = 1.1$ |
| Severance pay | $s = 7$ |

at the client firm, the worker receives 75% of the wage paid at firms in $E$. The mark-down of 25% seems to be in line with the little evidence on wage differentials for temporary workers that we are aware of (Segal and Sullivan (1997), Segal and Sullivan (1998), and Rudolph and Schröder (1997)). The mark-up on wages is 8%. Again, this is the size that is usually reported (Storrie (2002)). Finally, $W$ is a utilitarian measure of wealth that adds up values of jobs and values for workers in each state with $e$, $a$, $t$, and $u$ as weights.

Let us now turn to the comparative static results of our simulations. Increasing $m_T$ or $m_A$ by 20% to 3 shifts the aggregate matching function inwards. Potential reasons for such shifts have already been discussed in the previous section. Column three and four in table 4 summarize the results. Only those values are stated that change with respect to the baseline simulation. For the first case, we can observe an increase in regular employment and temporary agency work. Consequently, there is a positive net effect on regular employment when temporary agency work becomes more prominent. In aggregate more efficient matching through temporary work agencies does not crowd out regular jobs. Both types of employment, regular jobs and temporary work, appear to be complementary. The unemployment rate drops to

6.0%. Basically, the same picture emerges in the second case. When $m_A = 3$, employment increases by fairly the same amount. However, unemployment drops to 5.8% and temporary agency work increases more strongly than in the first case.

Columns five and six in table 4 show the results for different search effectiveness $c_T = 1$ and $c_T = 1.2$, respectively. Again, only values that differ from the baseline model are reported. If assigned workers are as effective in finding a job as unemployed workers, temporary agency workers ask for a higher wage ($\delta = 0.81$) to be compensated for the fact that a transition to regular employment becomes less likely. For $c_T = 1$ income of a temporary worker ($\delta \cdot w$) amounts to income from unemployment $b = 0.5$. If relative search effectiveness of assigned workers increases ($c_T = 1.2$), temporary agencies will take advantage of this by increasing the mark-down on wages. $\delta$ is 0.68 now. A lower search effectiveness reduces regular employment and unemployment. For $c_T = 1.2$ regular employment and unemployment is higher than in the baseline case. Temporary agency work drops to a share of the labor force of 2.5% if $c_T = 1.2$ but increases to 3.0% if $c_T = 1.2$. Note that if temporary agency workers are less effective in searching for a regular job, expected values of filled jobs and productive jobs increase. This is the case, because temporary work agencies can reap the benefits from a job longer if 'temps' find regular jobs less likely.

In the seventh column of table 4 we reduce per time unit hiring costs for temporary work agencies with respect to the baseline model. Say this occurs because requirements on reporting business activities to the public employment offices are dissolved. Those reports are mandatory for temporary work agencies in many European countries. Temporary firms' representatives use to argue that these administrative duties are major obstacles for employment growth at temporary work agencies. In our model, reducing $k_A$ leads to increases in employment and temporary agency work, and a drop in unemployment.

The last column of table 4 shows the impact of increasing severance pay. As already briefly stated with the results on the comparative statics of the model, it leaves labor market tightness unaffected but decreases the wage $w$. Higher severance payments allow temporary work agencies to charge a higher mark-up (17.6%). To make workers equally off between being unemployed and working at a temporary work agency, the mark-down on wages has to decrease. The mechanics behind that results become immediately obvious if one sets $c_T = 1$ in equation (24). Then, the mark-down is driven by the relation between income from unemployment $b$ and the wage. As wages fall with higher severance payments and $b$ is constant, $\delta$ has to rise.

Table 5 presents results of numerical simulations that deal with the crowd-

ing out aspect of temporary agency work. Quite often it is argued that deregulation of the temporary agency work sector will spur temporary employment at the costs of a reduction of regular employment. However, this is not necessarily the case. In our example the crowding out of regular jobs crucially depends on the search effectiveness of temporary workers. We simulate two deregulation scenarios. In one of which the matching efficiency for assigning workers at client firms is increased. In the other, temporary work agencies' costs for opening a vacancy are reduced. We state percentage changes in employment and unemployment with respect to the baseline calibration for different values of search effectiveness. If the matching parameter $m_T$ is raised at a search effectiveness that amounts to $c_T = 0.9$ we observe a drop in the unemployment rate of 11.23% and a decline in regular employment of 0.59%. More workers are employed at temporary work agencies (which follows from the fixed labor force assumption). Hence, a deregulation that aims at raising the matching efficiency of temporary work agencies does indeed crowd out regular jobs. That result also holds true for a search effectiveness of $c_T$ which assumes that assigned workers are as effective searchers as unemployed workers. However, there is no crowding out of regular jobs accompanying a policy that raises matching efficiency if relative search effectiveness is $c_T = 1.2$ or $c_T = 1.3$. Then, regular employment and temporary agency work increase. Qualitatively, the same picture emerges if we reduce the costs of opening a vacancy. As long as relative search effectiveness of assigned temporary agency workers is smaller or equal to one, regular jobs will be crowded out. If assigned workers are more effective searchers than unemployed workers, a policy that reduces temporary agencies' costs of opening vacancy increases both, regular employment and employment at temporary work agencies. Thus, a labor market with temporary work agencies as intermediaries that reduce frictions in matching workers and vacancies can contribute to more regular employment. It does so if this additional channel for transitions out of unemployment is not blocked by ineffective job searchers (who are assigned to client firms).

These findings may be interpreted as a policy complementarity which are seen as becoming more important in the evaluation of labor market policy measures. Our simulation, for example, suggests that deregulation of the temporary work agency sector will only not crowd out regular jobs if cutting costs for opening a vacancy at a temporary work agency are accompanied by measures that ensure sufficient high search effectiveness of assigned temporary workers.

# 6 Concluding remarks

Temporary agency work runs as a major theme in the European debate on appropriate policies to combat structural unemployment. Astonishingly, there has been done only little research on temporary agency work. Neither there is abundant empirical work, nor has this topic attracted much interest by macroeconomists.

In this paper we made an attempt to address some of the issues that occur important to us. We were trying to give an answer to one of the empirical regularities that can be observed: namely, why is it that we have been observing such an increase of temporary agency work in most of the European countries? Secondly, our concern was whether we could say anything about the often raised issue that deregulation of the temporary agency work sector would crowd out regular jobs. Alas those jobs were workers are protected by severance payments in case of dismissal and have the opportunity to bargain for wages (and consequently earn more than a temporary agency worker).

For that purpose we developed a Pissarides–Mortensen–style flow model of the labor market. The standard model was augmented such that it captures the most prominent features of a labor market with temporary work agencies acting as intermediaries. There are two types of firms, temporary work agencies and others. The former hire unemployed workers, keep them in the pool of idle workers paying a retainer fee, while trying to assign them to client firms where workers finally become productive. Thus workers can either enter regular employment from unemployment. Or they may get a job at a temporary agency where they may enter regular employment while being idle, or get assigned to a client firm, from which a transition to regular employment may occur. The other firms can open a 'regular' vacancy, which will finally become a regular job with bargained wages, and in case that the job goes sour are object to severance payments. Alternatively, they may open a vacancy to be filled with a worker from a temporary work agency.

In this framework we could show that temporary work agencies will come into existence as labor market intermediaries if a certain matching efficiency is reached for assigning workers to client firms. We argued that in the past decades many factors, such as technological improvements that allow posting of vacancies through the internet or deregulation of the sector, may have contributed to a better matching efficiency so that a threshold level was finally passed. Some comparative static results were derived, and where not, the impact of temporary agency work on the probably most interesting variables, like employment and unemployment rates, was simulated with a calibrated version of the model. For the numerical exercise we used econometric evidence were it was available, otherwise we plugged in parameters that we

think are plausible. After all we get a baseline model with features that match European economies quite well, given the still parsimonious structure of the model. The policy experiments conducted with the calibrated version of our model reveal that the emergence of temporary work agencies does not necessarily crowd out regular employment. It occurs that both, regular employment and employment at temporary work agencies, increase as long as the search effectiveness of assigned workers is sufficiently high relative to unemployed workers. This result may be seen in the light of policy complementarities, such that single labor market policy measures will not yield success. One rather has to launch a package of policies to assure positive results.

We are aware that our model has shortcomings. This criticism may for example apply to our assumption that unemployed workers do not have any bargaining power at all. This allows the temporary firm to drive the expected value of being employed as a temporary worker down to the expected value of being unemployed. Such a simplification takes away a lot of the computational burden, and paves the way for some analytical results. The assumption may not be a good one, even though we can give some evidence that backs it. We also assumed a constant returns to scale technology. Furthermore, we did not take into account so far, that there may be a productivity differential between workers on regular jobs and 'temp' jobs. But our assumption may be justified by case studies hinting that 'temp' workers seem to be not less productive than regular workers (Houseman et al. (2001)).

The variety of temporary agency work regulation among OECD economies is quite striking. Only some of them have been incorporated and evaluated in our model. Others not. Their effects, like transfer fees for training expenditures as they have been introduced in the U.K., on labor market performance still need to be evaluated.

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Table 4: Simulations

| Variable | Baseline model | $m_T = 3$ | $m_A = 3$ | $c_T = 1$ | $c_T = 1.2$ | $k_A = 4.5$ | $s = 8$ |
|---|---|---|---|---|---|---|---|
| W | 74.1592 | 74.1654 | 74.1660 | 74.1591 | 74.1593 | 74.1611 | |
| $J_{E,F}$ | 0.5730 | | | | | | |
| $J_{A,F}$ | 0.1830 | 0.2345 | | 0.1890 | 0.1780 | | |
| $J_{A,P}$ | 0.3630 | 0.3674 | | 0.3703 | 0.3569 | | |
| $J_{T,F}$ | 0.5730 | | | | | | |
| $\psi_E$ | 73.6966 | | | | | | |
| $\psi_A$ | 72.8370 | | | | | | |
| $\psi_U$ | 72.8370 | | | | | | |
| $\psi_T$ | 72.8370 | | | | | | |
| $\theta_E$ | 0.2280 | | | | | | |
| $\theta_A$ | 0.0084 | 0.0138 | 0.0121 | 0.0089 | 0.0079 | 0.0103 | |
| $\theta_T$ | 2.0523 | 2.9553 | | | | | |
| e | 0.9073 | 0.9078 | 0.9079 | 0.9052 | 0.9090 | 0.9075 | |
| u | 0.0658 | 0.0601 | 0.0580 | 0.0650 | 0.0665 | 0.0636 | |
| a | 0.0037 | 0.0032 | 0.0047 | 0.0038 | 0.0036 | 0.0040 | |
| t | 0.0232 | 0.0288 | 0.0294 | 0.0259 | 0.0209 | 0.0249 | |
| $\alpha_E$ | 0.4775 | | | | | | |
| $\alpha_A$ | 0.2288 | 0.2932 | 0.3295 | 0.2363 | 0.2225 | 0.2542 | |
| $\alpha_T$ | 3.5815 | 5.1573 | | | | | |
| w | 0.6142 | | | | | | 0.5642 |
| $q_E$ | 2.0941 | | | | | | |
| $q_A$ | 27.3169 | 21.3197 | | 26.4502 | 28.0894 | 24.5852 | |
| $q_T$ | 1.7451 | | | | | | |
| $\delta$ | 0.7473 | | | 0.8141 | 0.6804 | | 0.8135 |
| $f$ | 0.5 | | | | | | |
| $\sigma$ | 1.0798 | | | 1.1243 | 1.0352 | | 1.1755 |

Values of variables that do not change with the policy experiment as compared to the baseline model are not stated. Figures are rounded where necessary.

Table 5: Numerical example: crowding out

| | $m_T = 3$ | | $k_A = 4.5$ | |
|---|---|---|---|---|
| $c_T$ | $\Delta e$ | $\Delta u$ | $\Delta e$ | $\Delta u$ |
| 0.9 | -0.59 | -11.23 | -0.55 | -6.04 |
| 1 | -0.23 | -9.80 | -0.23 | -4.54 |
| 1.2 | 0.29 | -7.58 | 0.22 | -2.22 |
| 1.3 | 0.48 | -6.70 | 0.38 | -1.30 |

Change is in % with respect to the outcomes of the baseline model

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